

# **STRUCTURE OF A SCANNER CAPABLE OF ADJUSTING LIGHTNESS OF A LINE TO BE SCANNED**

## **BACKGROUND OF THE INVENTION**

### **Field of the Invention**

The invention relates to a design of adjusting the position of the light tube of a scanner, and more particularly to a design which may adjust the relative distance between the light tube and the line to be scanned on the document to be scanned.

### **Description of the Related Art**

An image capture device, such as a scanner, mainly uses light to be projected on a document, and the light after reflected or after penetrating may enter an optical reading device to proceed optical analysis. The light tube mounted on a common scanner has constant lightness and height, and the light tube of the scanner will be better if it has a greater lightness. When the lightness of the tube and the time for shifting out the charges from the CCD (charge coupled device) are properly selected for performing the low resolution scanning or black and white scanning, some problems may occur in the high resolution scanning or color scanning. Specifically, in the high resolution scanning or color scanning, due to the low capacity of the RAM (random access memory) in the scanner and the long period of time for shifting out the charges, the photo sensor in the scanner may be exposed to the light for a long period of time. Therefore, the CCD may be easily saturated in the high resolution scanning or color scanning.

1 For improving the above-mentioned problem of having a constant  
2 lightness, a manner of controlling the voltage or current of the light tube may  
3 be used, so that the light tube has different values of lightness according to the  
4 using conditions. However, the common scanner has a constant DC (direct  
5 current) voltage source, so that the pulse width has to be adjusted before  
6 adjusting the voltage. Thus, the ripple is easily caused, which produces noises.  
7 For eliminating the noises, complicated electronic members or circuit designs  
8 are needed to achieve the purpose. In addition, the noises cause instability of  
9 lightness of the light tube, which produces a blinking condition, thereby  
10 affecting the scanning result. The light tube is always subjected to the effect of  
11 changed voltage or current, thereby easily wearing the light tube and  
12 decreasing the lifetime of the light tube.

### 13 **SUMMARY OF THE INVENTION**

14 The invention is to provide a mechanic adjusting manner capable of  
15 adjusting the relative distance between the light tube having a constant  
16 lightness and the line to be scanned on the document. Thus, proper  
17 illumination is supplied on the document to achieve the purpose of adjusting  
18 lightness.

19 For achieving the above-mentioned purpose, at least one mechanic  
20 adjusting device is mounted between the chassis of a scanner and the light base.  
21 The adjusting device is operated according to the user's requirement to change  
22 the relative position between the light base and the chassis, so that the light  
23 tube mounted on the light base may be adjacent to or away from the line to be  
24 scanned on the document to be scanned. Thus, the purpose of adjusting the

1 lightness accepted by the line to be scanned on the document to be scanned can  
2 be achieved.

3 The adjusting device includes a pair of opposite electromagnetic  
4 members. The relative distance between the light base and the chassis may be  
5 changed by using the attractive or repellent action of the electromagnetic force.

6 The adjusting device includes an electromagnetic member and a  
7 magnetic material such as an iron, co-operating with a swing arm having an  
8 elastic property and mounted between the light base and the chassis. Thus, the  
9 electromagnetic member attracts the magnetic material, so that the light base is  
10 adjacent to the chassis. When the electromagnetic member is not acted  
11 (without magnetic force), the swing arm may push the light base away from the  
12 chassis. Thus, the purpose of changing the relative distance between the light  
13 base and the chassis can be achieved.

14 The adjusting device may be a cam whose circumferential curvature  
15 may be changed to push the light base, thereby changing the relative distance  
16 between the light base and the chassis.

17 The adjusting device may include other mechanic members, for  
18 example, worm wheels co-operating with worms, or linking lever mechanism,  
19 thereby adjusting the horizontal position or vertical height of the light base.

20 Further benefits and advantages of the invention will become  
21 apparent after a careful reading of the detailed description with appropriate  
22 reference to the accompanying drawings.

### 23 **BRIEF DESCRIPTION OF THE DRAWINGS**

1           Fig. 1 is a pictorial view showing the structure in accordance with  
2 one embodiment of the invention.

3           Fig. 2 is partial pictorial view showing the structure of the invention.

4           Fig. 3 is a schematic front view showing the structure of the  
5 invention.

6           Fig. 4 is a schematic top view showing the structure of the invention.

7           Fig. 5 is a partial schematic illustration showing the structure of the  
8 invention.

9           Fig. 6 is a state schematic view of the invention, showing the light  
10 base being adjacent to the chassis.

11           Fig. 7 is a pictorial view showing the structure in accordance with  
12 another embodiment of the invention.

13           Fig. 8 is a partial pictorial view showing the structure in accordance  
14 with another embodiment of the invention.

15           Fig. 9 is a partial pictorial view showing the structure in accordance  
16 with another embodiment of the invention.

17           Fig. 10 is a state schematic view of another embodiment of the  
18 invention, showing the light base being adjacent to the chassis.

19           Fig. 11 is a schematic view of the invention, showing the light tube  
20 being displaced vertically to adjust the relative distance with the line to be  
21 scanned.

22           Fig. 12 is a schematic view of the invention, showing the light tube  
23 being displaced horizontally to adjust the relative distance with the line to be  
24 scanned.

## **DETAILED DESCRIPTION OF THE INVENTION**

Referring to Figs. 1 and 3, the invention includes a light base 21 mounted above a chassis 11, and the light base 21 is provided with a light tube 22. An adjusting device 31 is mounted between the first end 12 of the chassis 11 and the first end 23 of the light base 21, and another adjusting device 32 is mounted between the second end 13 of the chassis 11 and the second end 24 of the light base 21. The adjusting devices 31 and 32 mounted on the two ends of the chassis 11 and the light base 21 may have the same component and the same operation state.

Further, referring to Figs. 2 and 3, the first end 12 of the chassis 11 may includes a lug 14 which is under the first end 23 of the light base 21. The adjusting device 31 is mounted on the lug 14 and the first end 23 of the light base 21. The adjusting device 31 includes two electromagnetic members 41 and 42 having a magnetic effect. One electromagnetic member 41 is mounted on the lug 14, and the other electromagnetic member 42 is mounted on the first end 23 of the light base 21. The two electromagnetic members 41 and 42 mate with each other. The two electromagnetic members 41 and 42 generate magnetic effect by introducing an electric current. By means of changing the direction of the electric current passing through the electromagnetic members 41 and 42, the opposite end faces of the two electromagnetic members 41 and 42 produce an attractive force or a repellent force. In addition, the first end 12 of the chassis 11 includes a locking hook 15, and the bottom face 25 of the light base 21 also includes a locking hook 26 adjacent to the first end 23. The

locking hooks 15 and 26 mate with each other, and form a locking state at the end positions.

The second end 13 of the chassis 11 may include a lug 16 opposite to the second end 24 of the light base 21. The adjusting device 32 is mounted on the lug 16 and the second end 24 of the light base 21. The adjusting device 32 includes two electromagnetic members 43 and 44 having a magnetic effect. One electromagnetic member 43 is mounted on the lug 16, and the other electromagnetic member 44 is mounted on the second end 24 of the light base 21. The two electromagnetic members 43 and 44 mate with each other. The two electromagnetic members 43 and 44 may generate magnetic effect by introducing an electric current. By means of changing the direction of the electric current passing through the electromagnetic members 43 and 44, the opposite end faces of the two electromagnetic members 43 and 44 may produce an attractive force or a repellent force.

In addition, the bottom of the second end 24 of the light base 21 includes a locking hook 27 which mates with the wall edge 17 of the top face 18 of the chassis 11. Thus, the end of the locking hook 27 is locked on the wall edge 17, thereby forming a locking state. Except the locking state of the locking hook 27 with the wall edge 17, the second end 13 of the chassis 11 may include another locking hook (not shown) to mate with the locking hook 27 on the light base 21, thereby forming a locking state therebetween.

The lug 14 is formed with a guide hole 19, and the light base 21 includes a guide column 28. The guide column 28 is mounted in the guide hole 19, thereby preventing the light base 21 freely wobbling on the horizontal face.

Further, referring to Figs. 2 and 4, a swing arm 45 is mounted between the first end 12 of the chassis 11 and the first end 23 of the light base 21, and has an elastic force for pushing the light base 21 upward. Another swing arm 46 is mounted between the second end 13 of the chassis 11 and the second end 24 of the light base 21, and has an elastic force for pushing the light base 21 upward.

The adjusting devices 31 and 32 mounted on the two ends of the chassis 11 and the two ends of the light base 21 have the same structure and manner of operation. Thus, only the manner of operation of one adjusting device 31 is illustrated.

When proceeding scanning action of low resolution or picture of single color, the consideration of saturation of CCD is comparatively little. Thus, higher lightness may be used to proceed scanning action. Referring to Figs. 5 and 11, the two electromagnetic members 41 and 42 are not energized, so that the two electromagnetic members 41 and 42 have no magnetic action. The light base 21 is away from the chassis 11 by elastic action of the swing arm 45. The two opposite locking hooks 26 and 15 are disposed at a locking state, thereby efficiently preventing detachment of the light base 21, and the light base 21 is fixed at the higher position. At this time, the light tube 22 is adjacent to the document 61 to be scanned. Thus, the lightness of the line 62 to be scanned on the document 61 to be scanned can be increased apparently, thereby satisfying the requirement of a quick scanning of the low resolution or the picture of single color.

1           When proceeding scanning action of high resolution or picture of  
2 multiple colors, referring now to Figs. 6 and 11, the two electromagnetic  
3 members 41 and 42 may be energized, and the opposite end faces of the two  
4 electromagnetic members 41 and 42 may form opposite poles. Thus, the light  
5 base 21 is adjacent to the chassis 11 by the attractive action of the magnetic  
6 force, so that the distance between the light tube 22 and the document 61 to be  
7 scanned is increased. Thus, the lightness of the line 62 to be scanned on the  
8 document 61 to be scanned can be decreased. During the scanning action of  
9 low lightness for a long period of time, the requirement of the high resolution  
10 or the picture of multiple colors will be satisfied.

11           The height of the light base 21 can be adjusted by the adjusting  
12 device 31. Namely, the relative distance between the light tube 22 and the line  
13 62 to be scanned on the document 61 to be scanned can be adjusted. Proper  
14 lightness will be obtained to satisfy the requirement of scanning. What is more  
15 important is, during adjusting the height, the light tube 22 of the light base 21  
16 always retain a stable lightness. Thus, the light tube 22 will not blink due to  
17 additional signals, thereby increasing the lifetime of the light tube 22.

18           The adjusting device 31 includes two electromagnetic members 41  
19 and 42. Thus, by changing the direction of the electric current passing through  
20 the electromagnetic members 41 and 42, the two electromagnetic members 41  
21 and 42 may produce an attractive force or a repellent force. When the repellent  
22 action is produced, the light base 21 is away from the chassis 11. The guide  
23 column 28 on the light base 21 is mounted in the lug 14 of the chassis 11, and  
24 the locking hook 26 of the light base 21 is locked with the locking hook 15 of



1 the chassis 11. Thus, the light base 21 can be stably positioned at a higher  
2 position without the swing arm 45.

3 In another design, the electromagnetic member 42 of the adjusting  
4 device 31 is replaced by a magnetic material such as an iron. Thus, when the  
5 electromagnetic member 41 is energized, it will attract the magnetic material,  
6 so that the light base 21 is adjacent to the chassis 11. When not energized, the  
7 light base 21 may be lifted to a higher position by the swing arm 45.

8 Except the structure of the adjusting device 31 which includes two  
9 electromagnetic members 41 and 42 co-operating with a swing arm 45, another  
10 equivalent structure is shown in Figs. 7 and 8, a cam 51 is mounted between  
11 the first end 12 of the chassis 11 and the first end 23 of the light base 21, and  
12 another cam 52 is mounted between the second end 13 of the chassis 11 and the  
13 second end 24 of the light base 21. The two cams 51 and 52 may be eccentric  
14 circles or have specific profile curve. The two cams 51 and 52 have the same  
15 structure.

16 Referring to Figs. 8 and 9, the first end 12 of the chassis 11 is  
17 provided with a lug 14, and the lug 14 is provided with a guide hole 19. A  
18 guide column 28 is mounted on the bottom face 25 of the light base 21 adjacent  
19 to the first end 23, and the guide column 28 is mounted in the guide hole 19.  
20 Thus, the light base 21 and the chassis 11 will not wobble in the horizontal  
21 direction due to limit of the guide column 28 and the guide hole 19. When the  
22 cam 51 is rotated, the light base 21 is displaced upward to be away from the  
23 chassis 11 and adjacent to the document 61 to be scanned. Thus, the document  
24 61 to be scanned has a higher lightness, thereby satisfying the scanning

1 requirement of scanning of the low resolution or the black and white scanning.  
2 Referring to Fig. 10, when the cam 51 is rotated, the light base 21 is displaced  
3 downward associated with its own weight to be adjacent to the chassis 11. Thus,  
4 the document 61 to be scanned has a lower lightness, thereby satisfying the  
5 scanning requirement of scanning of the high resolution or the picture of  
6 multiple colors.

7 Under the condition of the light tube 22 providing a stable and  
8 constant lightness, the cams 51 and 52 designed as the adjusting devices 31 and  
9 32, may also adjust the light base 21 by mechanic elements, to achieve the  
10 purpose of changing the lightness of the document. In addition, the mechanic  
11 adjusting devices 31 and 32 of the invention may be constituted by co-  
12 operation of worm wheels and worms, or by linking lever mechanism, or by  
13 equivalent elements.

14 Further, instead of two adjusting devices, there may only one  
15 adjusting device. At this time, the adjusting device and the spring or swing arm  
16 having elasticity and mounted on the center of the light base may also achieve  
17 the effect of adjusting the lightness of the light received by the document.

18 The invention may adjust the height of the light base 21, to adjust the  
19 relative distance between the light tube 22 and the line 62 to be scanned on the  
20 document 61 to be scanned, so that the document 61 to be scanned has a proper  
21 lightness. Except for adjusting the height of the light base 21, the horizontal  
22 position of the light base 21 can also be adjusted. Referring to Fig. 12, the  
23 position of the light tube 22 is changed accordingly. For the line 62 to be  
24 scanned on the document 61 to be scanned at the same position, the light tube

1 22 at different horizontal positions has different values of lightness due to  
2 different travel of the light. Thus, the purpose of adjusting lightness of the line  
3 62 to be scanned can be achieved.

4 While the preferred embodiment of the invention has been shown  
5 and described, it will be apparent to those skilled in the art that various  
6 modifications may be made in the embodiment without departing from the  
7 spirit of the invention. Such modifications are all within the scope of the  
8 invention.